

REMARKS

The Examiner noted certain informalities on pages 4, 7, and 9 of the specification. These have been corrected. Specifically, the word "of" has been inserted on page 4 and element number 96 corrected to 102. The sentence on page 7, lines 16-18 has the intent that the Examiner cited, which is that, for the example of FIGURE 2, an artisan can readily see that the relative position of the crank member is chosen during design to give the desired sweeping range for the transducer. To eliminate the possibility of the suggestion of introducing any new matter, this sentence has been deleted from page 7.

The reference characters have been deleted from all of the claims, thereby overcoming all objections to the reference characters.

Claims 1-6 were rejected under 35 U.S.C. §112, second paragraph, as being indefinite. Specifically, Claim 1 recited the term "the assembly" which was rejected for lack of antecedent basis. The term has been replaced with "scan head," the term used in the preceding line in the claim. It is respectfully submitted that this overcomes the rejection of Claims 1-6.

Claims 1-2, 4, and 7 were rejected under 35 U.S.C. §102(b) as being anticipated by US Pat. 4,762,002 (Adams). Amended Claim 1 describes an ultrasound imaging system, comprising a processing system configured to generate ultrasound energy and to detect signals at ultrasound frequencies; and an ultrasound scan head electrically coupled to the processing system, the scan head including an ultrasound transducer array operatively coupled to a positional actuator having a driven member that rotates in a constant direction about a first axis to oscillate the array about a second axis substantially perpendicular to

the first axis, the positional actuator further including a first pivot axis orthogonally intersecting the second axis and a second pivot axis rotating about the first axis and intersecting the first axis at a constant non-orthogonal angle. In designing a mechanically oscillating transducer probe it is desirable for a number of reasons to use a motor with a shaft which constantly rotates in the same direction. The challenge is to have a simple, reliable and accurately operating mechanism to translate the constant rotation of the motor shaft into rocking motion by the transducer array. Reliability and accuracy are improved by avoiding gear drives which exhibit backlash and gear slop, and a simpler mechanism helps achieve all of the objectives. Claim 1 describes a positional actuator which achieves these objectives by having only four motional axes: one for the driven member, one for the rocking motion of the transducer, and two to effect the motional translation, a first pivot axis which orthogonally intersects the transducer rocking axis and a second pivot axis which rotates about the first axis and intersects the first axis at a non-orthogonal axis. This actuator is simpler, more efficient, and more reliable than any shown in any of the citations. With specific reference to Adams, the Adams mechanism uses a motor which does not rotate in a constant direction, but rotates back and forth in a limited rotation mode of  $\pm 45^\circ$ . Instead of a pivot axis oriented at a non-orthogonal angle with respect to the motor shaft, Adams uses bevel gears 48, 50 and inherits their shortcomings. For these reasons it is respectfully submitted that Adams cannot anticipate amended Claim 1 and its dependent Claims 2-6 and 9-11.

Claims 1-4, 6-7 and 9-10 were rejected under 35 U.S.C. §103(a) as being unpatentable over Adams in view of US Pat. 4,579,122 (Shimizu et al.) Shimizu et al. employ

an even more complex mechanism that Adams by using a motor with a motor shaft 26 connected to a rotating shaft 32 of their conversion mechanism 30, which is connected to a dish-shaped rotation member 34 which is connected to a pivot shaft 36 which is connected to an arm 38 which is connected to a pivot shaft 46 which is connected to the supporting member 42 for the transducer 40 which is mounted on a swinging shaft 44. A similar mechanism of equal complexity is shown in US Pat. 4,282,879 (Kunii et al.) which was cited by the Examiner. Furthermore, both Adams and Shimizu et al. are moving only a single transducer element, not a transducer array as recited in Claim 1, and with thus only scan a single plane, not a volume as will a scan head as described in Claim 1. For all of these reasons it is respectfully submitted that Adams and Shimizu et al. cannot render Claim 1 and its dependent Claims 2-6 and 9-11 unpatentable.

Claim 5 was rejected under 35 U.S.C. §103(a) as being unpatentable over Adams in view of US Pat. 5,152,294 (Mochizuki et al.) While Mochizuki et al. employ a curved array, they, like Adams, use a gear drive 42 which is oscillated back and forth by constantly changing the rotational direction of the motor 40. Mochizuki et al. have an expected backlash problem with their gears 40, as they admit at column 6, lines 62-65. The combination of these two patents suggests nothing like the positional actuator described in amended Claim 1. Consequently it is respectfully submitted that Adams and Mochizuki et al. cannot render Claim 1 and its dependent Claim 5 unpatentable.

Claim 11 was rejected under 35 U.S.C. §103(a) as being unpatentable over Adams in view of Shimizu et al. and further in view of US Pat. 4,572,200 (Schroeder et al.) Schroeder et al. have an ultimately simple design,

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incorporating the transducer element 14 on the rotor assembly 12. There is thus only one pivot axis in the whole device, the shaft 16 on which the rotor 12 oscillates. Like Adams, the motor rotor must be rocked back and forth in a constant change of direction; the rotor cannot be driven continuously in one direction as Shimizu et al. do. Schroeder et al. have yet a third mechanism different from that of amended Claim 1. Accordingly it is respectfully submitted that the combination of Adams, Shimizu et al. and Schroeder et al. cannot render Claim 1 and its dependent Claims 9-11 unpatentable.

In view of the foregoing amendment and remarks it is respectfully submitted that the informalities in the specification have been corrected, Claims 1-6 are now clear and definite, that Claims 1-2, and 4 are not anticipated by Adams, and that Claims 1-6 and 9-11 are patentable over any combination of Adams, Shimizu et al., Mochizuki et al., and Schroeder et al. Accordingly it is respectfully requested that the rejection of Claims 1-2 and 4 under 35 U.S.C. §102(b) and of Claims 1-6 and 9-11 under 35 U.S. C. §103(a) be withdrawn.

In light of the foregoing amendment and remarks, it is respectfully submitted that this application is now in condition for allowance. Favorable reconsideration is respectfully requested.

Respectfully submitted,

JAMES BONER ET AL.

By: /W. Brinton Yorks, Jr./  
W. Brinton Yorks, Jr.  
Reg. No. 28,923

Philips Electronics  
22100 Bothell Everett Highway  
P.O. Box 3003  
Bothell, WA 98041-3003  
(425) 487-7152  
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